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BULGARIAN-MADE DIODES, TRANSISTORS

Sofia VOYENNA TEKHNIKA in Bulgarian No 4, 1978 pp 41, 42

[Unattributed technical tables: "Bulgarian Diodes and Transistors"]

[Text] The tables give the diodes and transistors produced in Bulgaria. In the tables, the following legend has been used.

For Diodes

$U_{R\,max}$ --constant inverse voltage.
$I_{F\,max}$ --constant forward current.
I_R --constant inverse current.
U_F --constant forward voltage.
C_{tot} --diode capacity.
trr --back resistance recovery time.

For Transistors

$P_{C\,max}$ --constant or average capacity of collector.
$I_{C\,max}$ --collector current.
U_{CE} --collector-emitter voltage.
h_{21E} --static transfer constant for current in circuit with common emitter.
f_T --transfer frequency.
F --noise factor.

Table 1

Diode number	$U_{R\,max}$ V	$I_{F\,max}$ A	I_R A	mode U_R V	U_F V	mode I_F A	C_{tot} pF	t_{rr} ns
D								
2Д5605	20	0.045	1μ	20	1	0.01	4	5
2Д5606	40	0.045	1μ	40	1	0.01	4	5
2Д5607	60	0,050	1μ	60	1	0.01	4	5
2Д5612	80	0.050	1μ	70	1	0.01	4	5
2Д5613	100	0.050	1μ	70	1	0.01	4	5
2Д5614	110	0.050	1μ	70	1	0.01	4	5
KD КД1101	100	0.3	100μ	—	1.2	—	—	—
КД1102	200	0.3	100μ	—	1.2	—	—	—
КД1103	300	0.3	100μ	—	1.2	—	—	—
КД1104	400	0.3	100μ	—	1.2	—	—	—
КД2016								
*Клас А	100	1	30μ	100	1.1	1		
Клас Б B	200	1	30μ	200	1.1	1		
Клас В C	300	1	30μ	300	1.1	1		
Клас Г D	400	1	30μ	400	1.1	1		
Клас Д E	500	1	30μ	500	1.1	1		
Клас Е F	600	1	30μ	600	1.1	1		
Клас Ж G	700	1	30μ	700	1.1	1		
Клас З H	800	1	30μ	800	1.1	1		
Клас И I	900	1	30μ	900	1.1	1		
Клас К J	1000	1	30μ	1000	1.1	1		
Клас Л K	1200	1	30μ	1200	1.1	1		
Клас М L	1500	1	30μ	1500	1.1	1		
КД2001	100	10	3m	100	1	10	—	—
КД2002	100	10	3m	100	1.25	10	—	—
КД2003	100	5	3m	100	1.5	5	—	—
КД2004	200	10	3m	200	1	10	—	—
КД2005	200	10	3m	200	1.25	10	—	—
КД2006	200	5	3m	200	1.5	5	—	—
КД2007	300	10	3m	300	1	10	—	—
КД2008	300	10	3m	300	1.25	10	—	—
КД2009	300	5	3m	300	1.5	5	—	—
КД2010	400	10	3m	400	1	10	—	—
КД2011	400	10	3m	400	1.25	10	—	—
КД2012	400	5	3m	400	1.5	5	—	—
КД2013	500	10	3m	500	1.25	10	—	—
КД2014	500	5	3m	500	1.5	5	—	—
КД2015	600	5	3m	600	1.5	5	—	—

* Class

Table 2

Transistor number	Type	$P_{c\,max}$ W	$I_{c\,max}$ A	U_{CE} V	h_{21E}	Mode U_{CB} V	Mode I_C mA	f_T MHz	F dB
2T3604	NPN	0.2	0.2	18	15÷280	5	10	300	—
2T3605	NPN	0.2	0.2	18	15÷280	5	10	300	—
2T3606	NPN	0.2	0.1	18	15÷280	5	10	300	—
2T3607	NPN	0.2	0.1	18	15÷280	5	10	300	—
2T3107	NPN	0.3	0.1	45	120÷460	5	2	150	10
2T3108	NPN	0.3	0.1	25	120÷800	5	2	150	10
2T3109	NPN	0.3	0.1	25	180÷800	5	2	150	4
2T3167	NPN	0.2	0.1	45	100÷460	5	2	150	10
2T3168	NPN	0.2	0.1	25	100÷850	5	2	150	10
2T3169	NPN	0.2	0.1	25	180÷850	5	2	150	4
2T3511	NPN	0.2	0.15	18	20÷330	10	1	120	5
2T3512	NPN	0.2	0.15	18	270	10	1	120	5
2T3531	NPN	0.25	0.03	12	32	3	10	—	—
2T3532	NPN	0.25	0.03	100	32	3	10	—	—
2T6551	NPN	0.8	0.5	50	26÷470	10	500	200	—
2T6552	NPN	0.8	0.5	40	26÷470	10	150	70	—
2T6554	NPN	0.7	0.6	40	8÷ 71	1.3	500	—	—
2T6555	NPN	0.7	0.6	30	8÷ 71	1.3	500	—	—
2T3841	PNP	0.3	0.2	12	15÷790	5	10	300	—
2T6821	PNP	0.6	0.5		> 20	10	150	60	—
2T3250	PNP	0.25	0.1	100	> 30	5	25	50	—
2T3851	PNP	0.25	0.1	60	> 30	5	25	50	—
2T9135	NPN	8	1	45	40÷250	2	150	150	—
2T9136	PNP	8	1	45	40÷250	2	150	60	—
2T9137	NPN	8	1	60	40÷160	2	150	150	—
2T9138	PNP	8	1	60	40÷160	2	150	60	—
2T9139	NPN	8	1	80	40÷160	2	150	150	—
2T9140	PNP	8	1	80	40÷160	2	150	60	—
GTГТ2306	PNP	0.15	0.1	12	15÷ 70	6	1	1.5	—
ГТ2307	PNP	0.15	0.1	12	25÷120	6	1	4	—
ГТ2308	PNP	0.15	0.1	12	40÷130	6	1	7	—
ГТ4124	PNP	0.35	0.5	15	20÷ 44	1	250	0.6	—
ГТ4125	PNP	0.35	0.5	15	40÷150	1	250	0.8	—
ГТ4130	PNP	0.55	0.5	15	25÷ 44	1	250	0.6	—
ГТ4131	PNP	0.55	0.5	15	40÷150	1	250	0.8	—
ГТ4143	PNP	0.35	0.5	25	20÷ 44	1	250	0.6	—
ГТ4144	PNP	0.35	0.5	25	40÷ 80	1	250	0.8	—
ГТ4145	PNP	0.55	0.5	25	20÷ 44	1	250	0.6	—
ГТ4146	PNP	0.55	0.5	25	40÷ 80	1	250	0.8	—
ГТ4350	PNP	0.3	1.5	16	50÷250	1	600	1.0	—
ГТ4351	PNP	1.5	1.5	16	50÷250	1	600	1.0	—
ГТ4352	PNP	2.5	1.5	16	50÷250	1	600	1.0	—
ГТ7301	PNP	30	3	15	20÷150	2	2 A	0.2	—
ГТ7302	PNP	40	3	30	20÷150	2	2 A	0.2	—
ГТ7303	PNP	40	3	40	20÷150	2	2 A	0.2	—
ГТ7304	PNP	40	3	60	20÷150	2	2 A	0.2	—
ГТ7312	PNP	40	6	30	20÷ 80	2	5 A	0.25	—
ГТ7313	PNP	40	6	40	20÷ 80	2	5 A	0.25	—
ГТ7314	PNP	40	6	60	20÷ 80	2	5 A	0.25	—
ГТ7325	PNP	40	10	70	15÷ 80	2	6 A	0.25	—

10272
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APPLICATION OF NUCLEAR TECHNOLOGY DISCUSSED

Prague RUDE PRAVO in Czech 5 Apr 78 p 4

[Article by Engr Stanislav Havel, CSc., director of the Institute for Nuclear Research in Rez]

[Text] The main research programs of the Institute for Nuclear Research in Rez near Prague concentrate on the development of nuclear energetics and technology. Indeed, as emphasized at the 15th Congress of the CPCZ, nuclear energetics represents the basic long-range solution of the fuel and power problem in Czechoslovakia. Nuclear technology and nuclear methods are also being applied more and more in the Czechoslovak Economy.

In addition to problems related to the construction of nuclear electric power plants in Czechoslovakia which are related to the preparation of their operation, questions of safety and influence on the environment, the institute also deals with, and coordinates on a statewide scale, certain tasks concerning the development of nuclear technology. Radiation technologies are being developed for the Czechoslovak industry, or new radioactive preparations for medical and biological purposes. The institute has developed and is preparing semiconductor detectors of ionizing radiation.

Experience gained from long-term research activities of the institute have shown that in addition to the tasks determined by the plan, with planned applications in the area of nuclear energetics and technology, the results of nuclear research can be applied in other fields of the Czechoslovak economy. Prompt applications of the results of nuclear research in nonnuclear fields may mean a significant contribution to the national economy.

In order to assist in dealing with the problem of broader application of the results of nuclear research in practice, the Institute for Nuclear Research organized at the end of last year a meeting, at which representatives of manufacturing organizations in various departments became acquainted with the results of research and development activities of the institute. The incentive to proceed with its organization came from the rationalization

movement in the institute. The meetings were held at the National Technical Museum in Prague, where exhibits were displayed at the same time under the name of "Institute for Nuclear Research for the Benefit of the National Economy", which became part of the permanent exposition on the history and development of nuclear research.

The discussions showed that nuclear technology and nuclear methods are finding more and more application in the Czechoslovak industry, agriculture, and medicine. The introduction of these progressive methods in practice means rationalization of operations, savings of manpower, energy, and materials.

Thanks to the initiative of scientific and technical workers of the institute, the technology -- which had been developed for transportation of burned nuclear fuels, based on the principle of fluorization of materials -- was used for dealing with the problem of regeneration of palladium catalyzers. These catalyzers are used in the chemical industry for the manufacture of rubber, gasoline, nitric acid, or lighting gas. The method developed in the Institute for Nuclear Research in Rez, which was tested in cooperation with the concern Chemopetrol-Kaucuk ["Chemical Petroleum -- Rubber"] in Kralupy, will be handed over to manufacturing establishments. It will save the Czechoslovak national economy several million krunas annually. The method of fluorization was also used successfully in cleaning of synthetic diamonds, and is now being used continuously at the National Enterprise Pramet in Sumperk. Since the method was introduced in 1974, roughly one million carats of synthetic diamonds were purified. They represent a value of about 5 million karunas.

The Institute for Nuclear Research has also developed the technology of radiation vulcanization of electric conductors with insulation made of silicon rubber. It will be used on the production line at the KABLO National Enterprise in Vrchlabi. By introducing this technology, it will be possible to maintain the production process continuously, while saving at the same time manpower, acreage, energy, and materials. In contrast with the heat vulcanization used at present, which involves the use of vulcanizing additives, radiation vulcanization takes place without using these additives, and the process takes place in cold. The assumed overall savings of production costs will amount to almost 4 million korunas annually, when the production line is introduced. By using ionizing radiation, one can also improve the properties of wood and prepare certain special chemical compounds.

Various enterprises, research institutes, and advanced schools are using intensive sources of gamma radiation, an experimental nuclear reactor, and other unique installations of the institute. The experimental nuclear reactor is used primarily by those who are interested in neutron activation analysis. This method, which is one of the most sensitive methods in the area of chemical analysis, helped to solve a number of important practical problems. For example, it helped to answer the question of wear and tear of wall panels in blast furnaces and the question of passage of the material from the panels in steel during the smelting process. On the other hand,

workers engaged in geological research use this method to determine the presence of minute amounts of geological materials in samples of rocks and minerals.

The Institute for Nuclear Research in Rez is also known all over Czechoslovakia because of its manufacture of radioactive drugs. Since 1974, radioactive drugs marked by radioactive iodine 131 have been distributed to hospitals all over Czechoslovakia. These preparations make it possible to replace painful testing procedures and help to make diagnoses more accurate." In 1971, nuclear methods were applied in 40,000 examinations, in 1976 the number of nuclear-medical examinations increased to as much as 200,000, and in 1980 their number will increase to as much as half a million.

A whole series of instruments developed in the institute can find their application in other fields as well, in addition to nuclear research.

Nuclear methods, procedures of nuclear technology, and instruments developed for nuclear research and used in various areas of the national economy have already brought values amounting to millions to the economy.

The present experience gained by the workers of the Institute for Nuclear Research have shown that the target results as well as secondary results of the handling of research assignments can be applied directly in other fields with success and bring the corresponding contributions. The prerequisite is a high professional level of the method used, comprehensive view of the author concerning the status of the problems, and especially his capacity to surpass the narrow framework of his workplace and of the task and his understanding of the urgent needs for the speediest application of the results obtained. The wealth of findings which have been accumulated represents a reserve of technical development for the Czechoslovak economy with maximum readiness.

Similar opportunities for revealing this reserve exist not only in nuclear research, but also in other fields of the Czechoslovak research and development base. The methods of speeding up the application of the results of research in practice can vary. The Institute for Nuclear Research in Rez shows one of the possible ways.

5668
CSO: 2402

APPLICATION OF NEW MEASURING SYSTEMS DISCUSSED

Budapest MAGYAR HIRLAP in Hungarian 26 Mar 78 p 5

[Interview with Dr Istvan Kiss, chairman of the National Scaling Office, by Jozsef Fahidy: "On the New Units of Measurement"; no date given.]

[Text] Istvan Kiss was born in 1923. He is a doctor of chemical sciences, and a full university professor. He graduated [from secondary school] in Bekescsaba and attended universities in Szeged and Budapest. He defended his doctoral dissertation at the University of Leningrad. He worked at the Central Research Institute for Physics for nearly two decades and at the headquarters of the International Atomic Energy Agency in Vienna for 5 years. Since October 1976 he has been chairman of the National Scaling Office. He is a member of the International Scaling Commission's presidential council. He received the Kossuth Prize in 1963 for results reached in the field of radioactive isotope research.

The National Scaling Office [OMH] is a central directing, supervisory and control organ employing almost 150 specialists with top-level training. The results of their work affect everyday life just as much as they affect developing branches of science. The matter of measuring is in a process of transition worldwide; it is being standardized and we cannot lag behind in this either.

"How does OMH work, what does it do, what are its tasks?"--our reporter Jozsef Fahidy asked Dr Istvan Kiss, chairman of the office for an answer to this question.

[Answer] Our task is to standardize the units and methods of measurement used on the national level to insure the accuracy of measurements. With the expansion of international industrial cooperative projects and trade,

adequate regulation in the matter of measurements, commensurate with international agreements are becoming increasingly important. For example, this has fundamental significance in the realization of CEMA integration. Demand for scaling regulation and control occurs in an increasing number of professional areas.

[Question] Public opinion knows very little about the office's function.

[Answer] It is true that the technical development and economic policy roles of OMH are hardly known to the public opinion, indeed many times even to the appropriate organisms. I think this is so because earlier the institute of scaling concerned itself only with the measuring instruments of trade and public works. Of course, in its activities today, routine technical services still carry great weight. (We certify more than 10 million measuring instruments annually.) But the tasks of the office branch out much more than this.

It takes care of the scaling tasks of the government, that is, prepares the regulations concerned with scaling, issues rules, may authorize other organisms to perform scaling activity and naturally supervises it. It is also among the office's tasks to represent the Hungarian government in the international scaling organizations and takes care of carrying out the international scaling agreements. The foundation of its technical work is to safeguard and improve on the standards of measurement, [etalons--from French].

[Question] Excuse me for interrupting, but what is an etalon?

[Answer] Expressed in technical language: the etalon is a measuring instrument the task of which is to define or embody, preserve or reproduce the unit of measurement (or the multiple or fraction of this unit) of some quantity for the purpose of making it transferable to another measuring instrument through comparison. We see to it that our etalons are reliable by regularly participating in international comparison measurement sessions. We have to work out the appropriate derivative regulations through which the units of measurement can be relayed from the etalons all the way to the measuring instruments in everyday use. In order to provide a picture about the character of this work, I can mention our time and frequency standards as an example. This cesium ray standard provides us with the unit of time, the second with an accuracy and stability of greater than 10^{-12} as a result of international comparisons performed every day. Currently we are comparing the standard with the Czechoslovak national time standard regularly, through a television channel. In the near future we will also begin regular comparisons with the Soviet standard. Every 10 days we send the results of the comparison measurements to the international headquarters in Paris, where through this process, our standard is registered as part of the international group time standard. Similarly, our time standard is also part of the international time standard composed of the standards of the CEMA countries.

[Question] What is the practical significance of this work?

[Answer] We regularly examine the standard measuring instruments of the enterprises which serve to check the measuring instruments used by the enterprise or manufactured by the enterprise, by comparing them with the international standard. The so-called type examination is another important activity we perform. Its goal is to establish whether an instrument or measuring tool satisfies the standards, or other scaling-related regulations and the requirements which are important from the viewpoint of lasting service.

Standardization is the checking of whether the measuring instrument shows the proper value within the given tolerances of error. It is a precondition of standardizability of a measuring instrument by the authorities that in accordance with the results of the type examination it should be suitable for its purpose. According to government orders, measurements which may have legal aspects must be performed with standardized measuring instruments. Thus we standardize all weighing scales, axle load measuring devices on the public highways, huge numbers of material examination machines, grain moisture meters, pressure gauges, fever thermometers, meters which measure electrical consumption, water and gas meters, and so forth. Even though certain control measurements are not required by the authorities, we are still asked to do them. I mention here for example the checking of the colors of the traffic signal lights.

[Question] How are you able to keep in step with the rapid developments in science and technology?

[Answer] Our technical activity would be unimaginable without an adequate research and development base. Of course, one must not think of independent basic research by this, but of the application of the new results of science within the measuring activity. Our technological development results are internationally recognized in some areas. To mention just two examples: in November last year the new scaling dosimetric laboratory was inaugurated near Vienna. Our results were used in planning it, and some of its standardization equipment was made in this country. Our instrument for measuring very low electrical current is used in the Mendeleyev Meteorological Institute in Leningrad, and also in other scaling institutions in other foreign countries.

But our development activity is built primarily on domestic relationships. As an example for this, I will mention our socialist contract made this year with the Miskolc University of Heavy Industry.

[Question] Government decree has been issued regarding introduction of new units of measurement. Why was this needed and what is its essence?

[Answer] Issuance of the government decree was necessary primarily because, in accord with the international agreements, the legal units of measurement will change in Hungary also. I must state in introduction that the changes

will barely affect the units of measurement used by the population in everyday life. We will continue to buy milk by the liter and bread by the kilogram, our body temperature will continue to be around 36 degrees C, and we will screw a 40-watt bulb into our reading lamp. We will be able to continue to give the speed of our car in kilometers per hour, but its performance will be indicated not in horsepowers but in kilowatts. (The 26 horsepower Trabant will have a performance of nearly 20 kilowatts, the 64 horsepower Lada, 47 kilowatts.) The unit of measure of pressure will be the pascal instead of the several types of units used currently; 1 atmosphere is about 100 kilopascals (kPc).

Actually we are talking about the following: at the present time different units of measurement are still in use in the various countries. For example, in a large part of the world the metric system is in use, but in countries of the Anglo-Saxon language area the yard and the pound are official measurements. Units of measurement used differ also in the professions (for example: the units of work or energy are: calory, erg, joule, watthour, kilopound-meter). The process is under way now all over the world to change over to the international system of measurement units. By the initials of the French name of System International, the widely spread designation of this is SI. This actually is an advanced developed variation of the metric system, and this is such a system of measuring units which derives the units of physical quantities from 7 basic units and in which one quantity has only one type of measuring unit. This can be used in trade, science and technology alike. But several units, which are so widely used that abolishing them would not make sense will also be kept on as legal units of measurement even though they do not fit into SI. Such are the liter, the hour or the units of calendar time: the day, the year as well as also the special units of some special areas (in atomic physics or in astronomy). It is also permitted to use units of measurement deviating from the decree if it is desirable to do in the interests of scientific research or foreign trade.

[Question] How will the changeover be accomplished?

[Answer] As of the beginning of this year, the Common Market countries have already changed over to compulsory use of the new system of units of measurement. In harmony with the CEMA recommendation, in Hungary the units of measurement included in the government decree will be the only legal units as of 1 January 1980. Obviously, a complete changeover will be gradual and require more time and great circumspection. But this year it will hardly be possible to sell an instrument with scale graduated in the old units of measurement on the capitalist market, where we would like to increase our export. At the same time, our domestic plants may continue to use their equipment measuring in the old units even after the deadline specified in the decree, as long as these are satisfactorily functioning or until their scales can be exchanged during repairs otherwise necessary anyway.

The changeover has several difficulties of course and is expected to have more. It is not simple, for example, to rewrite school textbooks and notes at the various levels of education, issue new technical tables, and use the old and new ones at the same time in the transition period. This work we are doing jointly with the Hungarian Bureau of Standards [MSZH] is currently one of our most important and difficult tasks.

8584
CSO: 2502

SCIENTISTS VOICE OPINIONS ON SCIENCE POLICY ISSUES

Budapest MAGYAR TUDOMANY in Hungarian No 4, Apr 78 pp 252-271

[Text] This journal has published in No 9, 1977 the resolution of the Political Committee about experiences gained in conjunction with the implementation of the science-policy guidelines and about current tasks in this connection. The document, which was received with great interest in scientific circles, has since been discussed in many meetings. Researchers and leaders of scientific affairs reviewed the broad field of science-policy tasks and expressed their views about implementation. It is our desire to offer a forum for these views, trying to emphasize some very important considerations. Our editorial board has therefore asked four questions from researchers and research-institution leaders working in various disciplines.

1. In your opinion, what is the effect of the OTTKT [National Long-Range Scientific Research Plan] on the scientific life of Hungary, and how could we establish closer relationship between scientific research and the needs of society?

2.How do you interpret the selective development of the research base; what practical steps follow from this goal for the modernization of the structure of the research network?

3. How do you regard the relationship between the universities and the research institutions? What forms do you propose to improve the cooperation between them?

4. What methods would you propose for the further democratization of the scientific life, its critical spirit, and especially the role of scientific public opinion in the assessment of scientific accomplishments?

We publish the answers in a group below, and add some opinions received by the editorial board dealing with these matters. We hope that these opinions will stimulate further debates in academic meetings and other forums, and that they will help in making impending decisions.

"It is Time to Subject the Decision Process Involved in Theme Selection to a Serious Study" [Opinion of Gyorgy Adam, academician, professor at ELTE (Eotvos Lorand University of Sciences)]

1. The long-range research plan promulgated in 1972 turned out to be a good framework for one kind of theme concentration and selection. We must clearly realize, however, that the OTTKT is merely a collection reservoir for most scientists, one that it pays to enter and move in. But there are more complex forces and factors which also affect the theme selection of the researchers. It is time to subject the decision process involved in theme selection to a serious study. The well-prepared, conscientious researcher who is just about ready to embark on a new theme weighs a large number of factors: obviously, a "closer relationship between research and the needs of society" is an important consideration; however, it is not sufficient by itself to affect the selection of the theme decisively.

2. Selective development of the research network is an obvious necessity in a small country; however, this must not mean that we are governed by ministerial considerations and develop separately the industrial research establishments, academic institutions, and — as poor relatives — the university departments. Maintenance and separate unfolding of these three research bases, isolated from each other, will merely result in the fragmentation of the intellectual and financial resources. Realization of a true coordination in this threefold system and the elimination of the triplication resulting from it is an important task of our science policy.

3. In my judgment, the university departments and institutes are the best research-establishment models. Of course, not under the present austere financial and intellectual conditions. But once we have developed a network of "major" research institutions in the country, they are the only logical ways to provide cooperation, even organic amalgamation, between the two research base systems. Many of the researchers (an honest statistical breakdown would be very interesting) operate in a dual fashion, namely within the framework of a university department and a research establishment. Why could we not follow this through logically and systematically, and why could we not specify or codify this duality?

4. Unfortunately we are hardly aware of each others' accomplishments insofar as basic biological and medical studies are concerned. The debates of the lecture meetings and special conferences flatten out, and we publish almost exclusively for foreign countries. We have a foreign orientation. Of course, this phenomenon by itself reflects the need for setting up a scientific yardstick. But it is a fact that those working in a given field need the ongoing constructive criticism and objective opinion of their peers at home. A suitable forum is needed for this. We do have many excellent journals in the field of domestic literature and art; we need a similar journal or similar journals in the fields of social and natural sciences. Such a monthly journal would publish not only scientific treatises but also major reviews, reports, critiques, and debates.

"The Realistic Assessment of the Research Network Determines the Need of Selective Development Too" [Opinion of Lorand Farkas, associate professor at ELTE]

1. The first National Long-Range Scientific Development Plan (OTTKT) has already had a major effect on research in Hungary; however, because of the large number of tasks it became more a guideline for the organization of the research themes than anything else. The second OTTKT, which was promulgated by the Council of Ministers in 1972, featured much fewer tasks, properly distinguishing between studies aimed at the solution of specific goals of the national economy and fundamental research themes. The researchers acclaimed the second OTTKT; however, the initial enthusiasm has decreased by now since the tasks became diluted and it became evident that the studies could not be organized on a truly collective basis, with true division of the research effort. There are many who regard the OTTKT as a flag, to be used to obtain financial support and recognition, but not as a realistic research plan. The following is the way toward a solution:

a) Within the featured tasks we must drastically reduce the number of themes, and we must retain only those of which the level is close to the international norm and those whi-h show the prospect of truly practical achievements. The decisive criterion should be whether these specific goals indeed serve the medium- and long-range goals of the national economy.

b) As long as the other areas utilizing the research results by industry do not have proper industry-branch or enterprise medium- and long-range strategies, there is little hope that a broad and closer relationship develops between research and practice; thus, it is important to achieve that those who utilize research results have forecasts and strategic goals.

2. Selective development in research means that we give featured support to those studies which

a) are needed;
b) support researchers and institutions yielding clear-cut results on the international level; and
c) concern subjects where there is a good prospect that the proper results will become available by the scheduled deadline.

Today these conditions are not usually met; instead, we grant major support on a subjective basis, determined by pseudoresults, force conditions, and relationships. It follows from the foregoing that we must at last assess our achievements realistically not so that a person or a committee "A" certifies that a person or a committee "B" qualifies (and the favor is returned on a subsequent occasion). The realistic assessment of the research network also determines the needs of selective development.

3. The relationships are poor since, as a result of autarchic development, the institutions do not demand cooperation. This is the case not only between universities and institutions but also between one institution and another. The true researchers and successful institutions practically never lack a partner: if they do not find it at home, they find it abroad.

The pettiness, jealousy, and sometimes the lack of proper professional competence are basic problems. There is also evidence of an incorrect view that cooperation should be established at all costs between institutions and not between tasks or persons. What does it mean, for example, that the technical university in Budapest and the Central Research Institute of Physics work together?Does everybody cooperate with everybody else, or are departments and sections cooperating with each other? I think it is the latter in most instances, but then why does Institution "A" work together with Institution "B"?

4. Since our country is small, there are only very few who are thoroughly familiar with a given subject. They either like each other or dislike each other. How can a proper debate develop under such conditions? With great difficulty. Those with a broad knowledge are regarded as generalists and if, for example, a musical composer speaks about organization he is regarded as an amateur since a composer is not supposed to be qualified to speak about organization. Thus, according to "theory," he cannot have a place in organizational discussions. Yet, a composer or a conductor is a unique organizer in his own field.

There will be no true debate as long as public opinion regards a commentator as a loudmouth since "it is simpler to agree with everything than to express a, perhaps abrasive, judgment in some professional matter." There will be no true debate as long as it can happen that scientists, no matter of what competence, are "appointed" rather then educated, and as long as a degree can be had by mere diligence, without any new discovery or real innovation. The aim should be that a good expert who cannot carry out research should not carry out research. There is nothing wrong with this: who is worth more, a high-quality engineer in chief or a poor-quality "scientific and technological advisor"? I think a high-quality engineer in chief is. We render no service to the individual either if we call him a high-quality researcher while he has no scientific accomplishment whatsoever to his credit. After all, everybody has the urge to achieve something in some field. Among true (not appointed) researchers there is always honest discussion and true democratism.

"Our Work Could be Much More Successful if We Could Create Institutions Which Provide Verticality" [Opinion of Janos Hollo,academician, director of the Central Research of Physics of the Hungarian Academy of Sciences]

1. Promulgation of the OTTKT in 1971 was a major event. Its creation in part was the result of the need resulting from the fact that the limited resources of the country available for scientific research had to be used in a systematic manner to ensure that the critical support volume could be assured for results.

While special grants did not enable us to carry out our tasks better, the authorities, including the Academy, did consider seriously the opinions of the coordinating councils when high-priced equipment purchases or foreign study trips were awarded. For example the coordinating council of the featured research theme "study of biologically active compounds" indeed supported the themes it judged important in such a way.

The major tasks and goals of the individual major themes and target programs were indeed defined clearly in the document representing the OTTKT; however, the thematic portion of the document is much too fragmented. The mere fact that national-level themes existed nonetheless gave a guideline for the individual researchers.

However, as a result of the thematic uncertainty of the main themes and target programs, as well as the excessive liberalism of the coordinating bodies, many themes became included among the major themes in the plan, which should not have been, or should have been only in part. It is therefore very important to seek those main issues within the existing main themes and target programs which match our social needs and which, if solved, decisively contribute to

accomplishment of our primary goals. Then, we should designate a relatively small number of well-defined research programs, which are financially and administratively well prepared, and see that they are carried out according to the plan.

Scientific research activity could match the needs of society much better if the main themes and target programs are formulated not only by the academic and industrial research institutions but also by those experts in industry, agriculture, and other productive branches of society who work in the field. Their voice should be increasingly heard. Research work which truly meets the needs of society should be esteemed higher — both in moral and material terms — than other research work.

2. The need for the selective development of the domestic research base also arises as a result of the limited extent of our resources. The research institutions must adapt themselves to the tasks facing research.

It follows from the foregoing that the tasks and thus the methods of research must be the following:

a) Gaining new knowledge (exploratory basic research);
b) Expansion of existing knowledge (supplementary basic research);
c) Utilization of existing knowledge (applied research).

In real life, things are not that simple; some research activities cannot be clearly classified as being in Category a), b) or c); also, their character may change as time goes on. Obviously, research work in Categories a) and b) is primarily the task of the universities in an extensive (disciplinary) sense. The academic research institutions should also carry out work of this kind, but they should adapt the work to the long-range needs of the national economy. The other research institutions should conform to the medium- and short-range needs of the national economy.

The concretization of the needs may be accomplished jointly by those authorities who are responsible for research supervision (the TPB [Science Policy Committee], OMFB [National Technical Development Committee], MTA [Hungarian Academy of Sciences], and the relevant ministries), on the basis of the needs of society, the facts of life in the country, and the world trends.

The present institutional structure of research (academic research institutions, university institutes, industrial research institutes, and enterprise research laboratories) more or less is on the basis of Categories a, b, and c. As a result (and for additional reasons) the relationships of various organizational entities are very loose. Our work could be much more successful if we could create institutions which provide verticality (such as a → b → c). Each and every institution should have an interest in the entire range between exporatory research and implementation (even marketing of the ultimate products).

3. There are usually debates following the papers delivered at various academic scientific forums (primarily sessions of working committees); these debates provide a very useful contribution to scientific information exchange and thus contribute to further research work. A sharp clash of professional opinions and the favorable or unfavorable evaluation of the scientific results presented is commonplace in every forum. No existential aspect of the researcher or the theme is involved here, there is no need to fear this. If, however, the position or the prestige of somebody becomes involved, the criticisms become much "smoother." We find the same thing in the evaluation of research reports and other presentations. We seldom find a theme where the words "major, significant, outstanding, of international importance" are not used. Only the degree of praise indicates the true opinion. Yet, we can take comfort from the fact that there after all is a ranking by the professional body both for the individual themes and the individual researchers.

It happens often that the debates of scientific events are niggardly since there are few real experts in a given subject. This is why we may state that the proper critical spirit is lacking in our scientific life and that we often encounter disinterest. The reason is the large number of research themes and the fact that research is insufficiently concentrated.

We perhaps should invite some foreign scientists to our scientific events; this might stimulate the spirit of the debates. Perhaps we may obtain help by implementing the practice of the MTA KKKI [Central Research Institute of Chemistry of the Hungarian Academy of Sciences]: Two opponents, appointed in advance, criticise the reports delivered at the meetings of the institute. These individuals had an opportunity to study the material carefully beforehand. In these circles, which are relatively secluded from publicity, the professional debates are quite lively as a result.

Upper management should stimulate those who criticise and express opinions: every researcher should be aware of the fact from the very beginning that praise is due to those who offer constructive criticism.

4. The research institutions have many cooperation agreements with the universities. Unfortunately, most of these agreements are only formalistic. True research cooperation exists only in a few cases. Good cooperation is usually based on personal relationships. There is nothing wrong with this; however, it does significantly impede the extent of joint endeavor. The universities are not interested in the inclusion of experts from the research institutions in the educational process. Nor are they interested in sending students preparing their dissertations to the academic institutions since this would deprive them of the production of the young people. Yet it would be very useful if the young researchers could benefit from the use of the laboratories of the research institutions, which as a rule are much better equipped than the university laboratories. On the other hand, the presence of the young people could stimulate the staff of the research institutions.

A closer cooperation of universities and research institutions would be feasible in centrally featured programs, by joint management. Cooperation based on the division of labor could be best realized in such joint (research institution - university department) projects. This would also raise the support level of university studies.

Study of biologically active compounds is a ministry-level major research subject of the MTA. The coordinating council of this theme prepared a research program for the years 1977-1980, which would contribute to the development of drugs on the basis of the explored relationships between chemical structure and biological effectiveness. The council coordinates these programs, in which three academic institutions and five university departments participate. The financial support of the studies is ensured by the general secretary of the academy from the central research support fund of the MTA. This extra financial support creates the possibility of effective cooperation among the participants, and ensures that the studies proceed in an optimum manner.

"A Modern Research Network is One Solving a Problem Requiring Solution on the International Level in an Adequate Manner" [opinion of Jozsef Knoll. academician, professor at SOTE (Semmelweis University of Medical Sciences)]

1. The viev — which was still held generally during the recent past — that it is offensive to mention the matter of practical usefulness when discussing "basic" or "fundamental" research, as apart from "applied" research, gradually loses ground. The OTTKT plays the role of the catalyst in this development. More and more we hear the obvious opinion: it does not matter if research has a socio-economic benefit; indeed, this should be our primary goal. The more strongly we oppose the artificial separation of basic and applied research, and the more we support those who coordinate their research goals with the needs of society, the better will be the relationship between scientific research and society.

2. The research network is like a container; we may fill it with whatever we want to fill it. Let us take pharmaceutical research for example. Such research is being carried out in university, academic, and industrial research institutions. The potential research capability may operate in a fragmented manner, everyone using his own initiative. In this case too, personal relationships will develop among the institutional staffs since the nature of the research is such that complex analysis is required. Of course, there will be successful projects and unsuccessful projects. The question is whether we measure the results or whether we do not. Today we merely register the activity of the entire research base; efficiency cannot be optimum. For the selective development of the research base we must develop — on the basis of the overall evaluation of domestic research results, the state of international research, and the needs of our national economy — an objective method for the selection of specific research goals, so that we can concentrate our efforts toward their accomplishment over the long range (at least ten years). Once we do this, we can give a true meaning for the work of our research network. Of course, we must also establish methods for the objective surveying of the research forces assignable to the goals on a nationwide basis, and we must develop the optimum management, research integrity, and moral leadership for the work, as well as a method of financing. A modern research network is one solving a problem requiring solution on the international level in an adequate manner. Such modern research should be promoted if the work is to serve our national economic goals.

3. The research establishments should be supported to permit them to achieve their set goals. The support should be in proportion to their accomplishments, primarily in the form of contracts. If the researcher always has to demonstrate his capability and if the extent of support depends on his accomplishments, he will be prompted to do his best. The researchers working in various establishments (the academy, the universities, or industry) are related only by jointly studied problems. This is the only natural relationship in research since it is not formalistic. Even today, those relationships are the liveliest among university departments and research institutions which were created by jointly studied problems. If we have properly formulated our research goals, they must have been advertised so that each and every research establishment could make suggestions and offer its cooperation in its special way. This mechanism will establish organic relationships among the research establishments.

4. The national-level authorities must analyze the place and weight of the achievements of the research institutions in international research on an ongoing basis. The appropriate academic committees must be asked to prepare

a balance sheet every three years of the domestic accomplishments of the institutions under their jurisdiction, based on a review of the international literature. This evaluation should be discussed by the appropriate academic department and published for debate in a Hungarian-language publication of the academy.

"The Economic Development Leadership Should be More Resolute" [opinion of Andras Levai, academician, professor at BME (Budapest Technical University)]

1. The reason why the relationship between the OTTKT and real life — including the scientific life of the country — is not as close as it should be is, in my opinion, that the long-range goals and guidelines are not sufficiently well known, and perhaps not been formulated to the proper depth. In order to achieve a closer relationship between scientific research and the needs of society, we must ensure that the economic leadership becomes more resolute. In financing the research institutions not associated with industry we must find a way for promoting the accomplishment of those goals which serve specific society needs — at least in the field of the technical sciences. In my opinion, the multiple-step system of research supervision which we have (Science-Policy Committee, OMFB [National Technical Development Committee], industrial ministries, Ministry of Education, the academy) is unfavorable. Nor is there sufficient information flow, so that parallel studies utilize much of our forces. (This is also the case in the procurement of parallel licences.) I think that we should make a thorough study, once and for all, of the principles used by other socialist countries which are better organized than Hungary in this respect (such as the German Democratic Republic).

2. The basis of the selective development of the research base is obviously a selective industrial policy. However, the basic question is that whatever we have once decided in the area of industry development, we must also implement. (Unfortunately, there are examples to the contrary in areas where it would have been desirable to stick to our industry-policy decisions on the basis of our traditions and intellectual resources.) Another aspect of this subject area is that — in my opinion — many of the research establishments which are independent today should be combined with large enterprises or industry trusts. I believe that it is an important matter that we carry out in the future studies aimed at the rationalization of material and energy utilization. We should make a serious study of the reasons why there are consistently unspent amounts of the central technical development fund each year.

3. By and large, the relationships between the universities and the research institutions are not good. But there are also examples of good relationships (for example between the MTA and the committee on engineering mechanics of the BME). We should give serious consideration to the combination of certain research institutions or parts of them with universities. But at the same time we should remove the restrictions which exist today on the size of the university research staffs.

4. Given the psychological conditions of Hungary (a small country with many talented citizens, much jealousy and greed), it is possible — in my opinion — that weak leadership is often the reason for the problems we are discussing. "A democratic public life can exist only under expert, systematic, and open leadership." The occasional lack of this may be one reason why there are so few people in industrial enterprises who try to obtain a scientific degree. (In most instances this would be to their disadvantage.)

"We Should Selectively Designate the Research Tasks" [opinion of Erno Pungor, academician, professor at BME]

1. The OTTKT was prepared on the basis of one of the possible science-organization models. The thoughts of the researchers on research were compiled, organized, and corrected by bodies in charge of scientific affairs and government organs. Finally, certain portions were highlighted. This organization model has the important realism of requiring optimum research performance from everybody in the area of his preference, and of giving as much research freedom to the researchers as could be expected only in a rich country, and even there only for a limited number of people, as well as to those for whom research is only a part-time activity (university educators) or those who are so imaginative that they are expected to start entirely new breakthroughs in science.

It is possible that in some instances there is agreement between the ideas of the researchers and the needs of society; the research-organization model used does not exclude the possibility that the proposed research in Hungary just conforms to the needs of society. However, it does not offer any assurance that this will be the case. If we are to establish closer relationships between research and the needs of society we must use another science- and research-organization model. There are several such models. I will not go into their description here.

2. It is not clear to me what is meant by the selective development of the research base. It would be much clearer to me if we would speak of research theme selectivity with the short- and long-range science- and economic policy goals of the country in mind. It is my opinion that the Hungarian

researchers, individually and as a group, are quite capable of working at a level meeting the international standard if they are allowed to concentrate their forces. Of course, in my opinion this applies both to fundamental research and also technological research or development work. I therefore think that we should designate the research tasks in a selective manner instead of discussing the structure of the research network.

3. The relationships between the universities and the research institutions are manyfold and not entirely clear. There are socialist agreements between individual research institutions and universities, and there is also much individual-to-individual cooperation and assistance. No general scheme can be given for the relationships in this area.

Here again, I think that the question is to make selective use of the research capability in both of these sectors for the benefit of our country's present and future. I think we should stress fundamental research in the universities and applied research in the research institutions. This would create the new basis of cooperation between the universities and the research institutions since they would supplement each other. I do not believe that there are possible any stronger relationships than those developing from such an arrangement. I do not believe that there is an alternative for this, certainly not such arrangements where people have part-time positions in each of the two systems, where unpaid consultantships are established, or where honorary titles such as titular professor or the like are awarded.

4. As I have mentioned in the first item, scientific freedom is greater in Hungary than is good for the country as a whole. But this freedom is in a sense a "feudal" freedom; there are many areas in which the effects of scientific and public rank are more pronounced than the inner truth of science. We must stress that scientific schools developed where they did always in those areas where scientific criticism was not suppressed. The realistic evaluation of the results is essential for our scientific development, yet we are still far from this, both in terms of methodology and content. Reviewing the memories of academic surveys, we find that it is a wrong approach to evaluate an entire institution or an entire scientific discipline in a global manner. Only specific accomplishments can be evaluated. We must also realize that citation by the international literature does offer some guideline of the quality of the research, and also offers maximum publicity (this applies only to natural sciences, where I am competent, and not necessarily to social and economic sciences, where I am not competent to make a judgment). There is no such control in target-oriented research studies. I therefore think that it is very important to create a non-industrial, high-level scientific council which can perform these evaluations on a professional basis.

"We Cannot Delay the Establishment of a True University Much Longer" [opinion of Sandor Rajki, academician, director of the Agricultural Research Institute of the MTA]

1. When we decided 22 years ago to specialize in order to make research more efficient and to shorten the pass-through time of research results serving real life directly to introduce new species and agricultural methods, as well as to utilize the liberated research capacity on the complex study of certain selected agricultural crops, the scientific institution in Martonvasar — as well as all other scientific institutions of this kind at that time — resembled an Oriental bazaar, where studies went on of practically every plant that grows in Hungary, from coriander to cotton, from chicory to sunflower, from oats to grass, from lion-flower to wheat, and from maize to bass. The specialization, in the course of which we concentrated the research capacity in Martonvasar on the complex study of wheat and maize — two of our most important crops — stood the test of time; it was carried out in conjunction with the use of the institute's experimental farm, and thus significantly reduced the pass-through time. In a short period of time, from a historical point of view, we achieved scientific results which contributed to the reputation of Hungary even beyond the borders of the continent. As a policy, it agreed with the then current science-policy guidelines, which have been effect for the last ten years. Although we achieved the goals without special effort, the road to the results was not always devoid of pain. As an example, I mention the obstruction faced by the institute and its experimental farm periodically, usually "from above." It always wasted much creative effort to overcome such obstruction.

Insofar as efforts aimed at providing a better balance between domestic research and the needs of the national economy are concerned, we believe that they are appropriate. However, on the basis of past experience, we observe them with mixed feelings. a) Surely, far more than half of the domestic research and development expenditure goes for projects directly serving the needs of the national economy; thus, little is left for fundamental research. b) Presumably, more than half of the research and development expenditure, which in theory should be expended only for the direct meeting of the needs of society (such as the technical development fund), is expended for purposes not truly research and development in character. c) The many agreements which are designed to implement the social harmony between scientific research and the needs of society seems to bureaucratize, rather than to orient, research. d) For these reasons, I believe more than I ever did in the validity of my remarks made in the debate on the "status of scientific research" on 17 March 1969, when I said the following:

"It is true that technical research does not help industrial development as much as it should, but the reason for this is the discontinuation of the factory laboratories 20 years ago! The solution of the problem is not the system of contracts and the proposed remuneration policy since the latter, in the proposed form, is contrary to the true nature of research! The correctness and usefulness of research results can be evaluated only from a perspective of several years. It seems to be a rule that the longer a major theoretical and practical achievement takes to be evaluated, the more important it is. Thus, it is not possible to reward results in research as in industry (production). This method is not practised in the West or in the United States either. The situation applicable to industry is, incorrectly, applied to research. The proper solution is this: Let us return the laboratories to the factories so that they need not make contracts, or that they need to make them only seldom. The researchers should be paid, better than they are now, on the basis of their performance over the years. Special awards or bonuses should be given only in exceptional circumstances."

2. In that one-third of the world where we live, food will remain the major problem for a long time in the future. This evident from the present situation and from the expected trends. This factor determines objectively the need for priority to be given to agricultural and agrobiological research in Hungary too.

3. We lack a true university, yet the importance of the universality of science, and both of analysis and synthesis, increases rapidly in the fields of science. The university framework is the best organizational system for this. Of course, historical tradition is a powerful force, and it is to be feared on the basis of experiences available from the socialist countries that the present structure will be idealized and not a new trend will be outlined. The solution is indeed a major problem; however, we cannot delay much longer the formulation of the proper policy perspective and its implementation in a well thought-out, systematic manner, if we are to remain competitive. A good first step step might be to increase the number of university educators at the expense of staff increases in scientific research institutions. This would give the universities more time for research and would also affect the educational level in a favorable manner.

4. General implementation of democracy is the only dependable way for democracy in the scientific life, for a healthy critical spirit, and for a more objective evaluation of the results of science than we have today. In science it is especially important to permit minority views to be expressed and defended. Without this, we cannot speak of creative science.

"Selective Development of the Research Base is a Means to Achieve a Goal but not the Goal Itself" [opinion of Mihaly Sandory, candidate of technical sciences, department head at the First Main Department of Natural Sciences of the MTA]

The selective development of the research base in general, and the institutional network of the MTA in particular, is a means to achieve a goal and not the goal itself. In my opinion, our major problem which is yet unsolved and which has not been emphasized sufficiently is to formulate in proper depth and with the proper specificity those goals which we desire to achieve by means of selective development. It is perhaps permissible to simplify this problem by classifying the goals in two groups. First, we must make fundamental research more efficient; second, we must improve the research-development-production-implementation chain. The change in the role of science — which is often mentioned, perhaps too often at the present development level of our national economy — in terms of the research network of the academy is the source of our major tasks.

The likely way to make fundamental research more efficient is concentration, improved research infrastructure, and theme selection. I desire to stress, however, that these approaches must be used in accordance with the needs of the scientific disciplines concerned, the research themes, and the general facts of life. In some instances, perhaps, an approach may represent proper concentration for a given theme, and it may be maximum efficiency if a single researcher studies it. Staff increases and any amalgamations may be useful in some specific instances. Furthermore, theme selection is usually examined in the light of short-range economic goals. This, in my opinion, is incorrect. Other considerations apply when we select the themes for fundamental research. It makes sense to carry out any fundamental research project, indeed it is necessary to carry it out, if it promises above-average success, depending on the nature of the theme. In this respect, therefore, I propose the following formulation: We should study all themes which have a promise of success within the framework of our fundamental research funds, which represent a non-negligible percentage of our national product. From the other side this means that we are not to carry out "poking" research or expend funds for such research. What is a "promising" research project must be examined case for case, based on short- and long-range tasks of the building of our socialist society. This is perhaps the most difficult aspect of the implementation of the relevant party resolutions. But it is the most important aspect insofar as fundamental research is concerned.

Improvement of the research-development-manufacture-utilization chain requires the solution of other kinds of problems. In my judgment, some of these problems cannot be solved introvertly within the academy. I mention only two elements of the chain, stressing that even a sketchy outline of the subject would require a full treatise. One is this: fundamental and applied research should be preferably carried out where it is at least probable that society, the national economy, or perhaps industry or agriculture will find the results beneficial. The other is this: The ultimate goals of the themes must be chosen in accordance with the needs of subsequent utilization. Research should not be terminated where it ceases to be interesting or — and this happens often — where the study cannot be continued to a degree where direct benefit would be forthcoming because of a lack of objective conditions. In the latter case — and this is what I primarily mean when saying selective development and change of the structure — we either change the set of conditions to make it meet the needs of utilization or, if this is not feasible, we must not start or continue the study even if it is interesting or praised abroad (at least not on the basis of possible utilization).

"We Often Inventory the Scientific Activity Rather Than Coordinating It According to Merit" [opinion of Istvan Szabolcs, Dr of agricultural sciences, director of the Research Institute of Soil Science and Agricultural Chemistry of the MTA]

1. The OTTKT was partly responsible for the fact that domestic scientific research recently is more geared toward specific problems of the national economy. The social demand which expects more from domestic scientific research for direct utilization or indirect utilization in production is fully justified.

Insofar as the "productivity" of the work of the OTTKT is concerned, too much intellectual and financial effort is exerted for administration, and as a result we often inventory the scientific activity rather than coordinate it according to merit. One reason for this is that the administrative and coordinating organs sometimes lack the funds for the research. However, another reason certainly is the methods of operation employed. It is easier and more convenient to inventory the manyfold and broad research activities and to try and combine them in reports and surveys, than to perform the thankless and delicate task of coordination and overall supervision. This is one reason for the phenomenon that is pointed out in the document entitled "Experiences and Current Tasks of the Implementation of the Science-Policy Guidelines of the MSZMP KB [Central Committee of the Hungarian Socialist Workers Party]," namely that our intellectual and financial resources are still not sufficiently concentrated on the most important tasks.

2. Selective development of the research base is indispensable in a small country like Hungary. It is evident by now that we must and should promote those science disciplines which have the conditions for successful research and of which the development is in the best interests of our society. While it is easy to agree on the general principles, it is difficult to implement practical measures. Obviously, it is unlikely that there is a science discipline which believes that it should be reduced rather than developed, although this would become necessary for the selective development of the research base. In order to accomplish this, we must not only put aside the subjective evaluations of science disciplines and scientific achievements. We must also establish coordination according to the merits and based on the evaluation of the status of research on a national level.

In my opinion, international relationship in general, and socialist integration in particular, is a very important aspect of the selective development of our research base. In the cooperation within the CEMA and among the socialist countries we need less administration and paperwork and more efficiency. There are many research areas in which the results of one socialist country or another may be adapted to the needs of another socialist country. This, if properly implemented, could save us much, and would also save in the development of the research base in other countries.

3. The relationship between the universities and the research institutions is a basic prerequisite for the further development of either. In Hungary there was perhaps a too fast and too polarized growth and separation of the university departments and research institutions. One cannot say they they do not cooperate with each other; however, it is certain that the degree of cooperation is inadequate.

It would make sense to utilize better the cadre of experts in the research institutions for university education. The same applies for the laboratories, instruments, and the entire research setup of the institutions. It is a very good custom, as it is practised in some instances, to have students or young university faculty members work for various lengths of time in research institutions before they complete their dissertations or doctoral theses. In research it is very important that the researchers do not become detached from higher education, and they should also do their share in educating future scientists. There are many good examples for this kind of cooperation: research institution scientists hold university courses and act as occasional lecturers. This activity should, and must be promoted.

The often stimulating appeals of the existing regulations and higher authorities provide the prerequisites for the further improvement of this cooperation. However, ultimately this depends on the leaders and staff members of the university departments and research institutions, specifically on the good and comradely relationships and cooperation among them.

4. Democratism of scientific life is a subject with many ramifications; it cannot be limited to the fight against monopolistic practices, against subjectivism, or the like, although these do exist in our scientific life and we must fight them continuously. The most important aspect of the democratism of scientific life is that everybody — the young researchers, the veteran research leaders, and everybody else in between — is imbued by the need to search for objective truth in his discipline, to obtain the proper approach, and to implement properly the existing needs of society. The plans, the intermediate results, and the final results of research must be presented to the public so that the specialists in the field can express freely their opinions and exchange their comments. This would make the scientific results better, stop errors in their incipiency, and would bring us closer to the objective truth.

Unfortunately, there are still many obstacles in our country to this, especially in cases where the evaluation of the scientific research deteriorates into personal attacks or — which is just bad — glorifications. The worst possible thing is when somebody regards objective criticism as a personal insult. It is an honor, rather than an insult, for somebody to receive an evaluation of his scientific results, even if the evaluator does not agree with the results. There has not been a researcher who, at some point of his career, has not found out that a pet theory of his was incorrect or erroneous.

We must say that there is relatively little scientific debate in our scientific events or journals. In some cases this is due to convenience, and in some other cases it is due to fear of repercussions. I think that examples for both may be quoted.

In improving the democratism in scientific life it is important not to spoil or pollute the spirit of the professional community and the public opinion. If good and useful scientific accomplishments receive praise, and if incorrect or sometimes unfounded results receive criticism, the reaction of most scientists will be favorable. If, for whatever reason, this is not the case, the attitude of the scientific community will also reflect this fact.

"We Must Raise the Supervision of the Various Areas of Our Economic and Technological Affairs to a Much Higher Scientific Level" [opinion of Janos Szita, Dr of economic sciences, deputy minister, head of the International Economic Relations Secretariat of the Council of Ministers]

1. In my opinion, OTTKT has a favorable effect on our scientific life, and affects the selection of our major themes. But I believe that this effect is not as large as it should be, primarily because much of the OTTKT encompasses the scientific work being carried out anyway and uses the concepts developed in our scientific institutions anyway. It takes less cognizance of the needs as they emerge from the practical side. We speak much, and in many ways, about the relationship between science and practice; however, we seem less to be able to achieve positive results toward the accomplishment of this in practical terms. The least we can say is that the degree to which we achieve this varies from one science branch to another and from one scientific institution to another. We may say just as much that scientific activities became detached in many areas from practice as of the lack of the scientific foundation of practical work.

At the present stage of development I would emphasize that we must raise the supervision of the various areas of our economic and technological affairs to a much higher scientific level. Today it is no longer possible to perform high-level leadership solely on the basis of accumulated practical experience; we must make use of the latest scientific achievements in a systematic manner. Among others, this necessitates

- that the leadership of society is continuously informed about the accomplishments of science. This means both the accomplishments in the country and the advancements on a worldwide scale. A suitable information system must be developed for this purpose.

- that the scientific community is continuously informed about the problems encountered in the leadership of society.

- that new institutional forms must be developed in many areas for the organization of the joint efforts of practical experts and scientific workers. What we need is not scientific consultation but true joint work and responsibility. There are many ways in which this can be implemented: we may establish development councils in certain areas where the researchers and practical managers work together; we may render ad hoc committees to handle certain complex matters; we may organize joint work in our day-to-day affairs (meaning not at the institutional level) where we have an opportunity to joint debates and work together in an effective manner.

This approach must be fed back so that OTTKT can be further updated, primarily by making sure that the tasks of scientific endeavor are determined solely by the practical needs of the economy. It would therefore be necessary to supplement or modify the OTTKT so that while it does not exclude the scientific workers from work on the formulation of the plan, it does ensure that the needs to be met by the scientific work are determined by those institutions which are responsible for the practical operations, who would also lay down the priorities.

2. We must develop primarily those research bases where the activities place tasks in front of the researchers which cannot be handled on the basis of the existing research base. The development ideas should not originate solely from the researchers. Of course, this should not be implemented in an extreme fashion either; the ideas of the researchers cannot be swept into the background. Yet, the final word belongs to those who represent institutions which determine the practical needs for the building of socialism.

A periodic review of the priorities must be stressed. This permits the reduction of the priority of such projects which had priority earlier in cases where new needs emerge. If this review does not take place, we must consider the establishment of a new research base whenever there is a new need. In my opinion, the development of a research base should be exceptional; what we need is a more rational and effective utilization of the existing research bases.

3. In considering this subject I start from the fact that today every serious research project represents the activity of a small or a large team. These teams not only involve the participation of several persons; it also means that there is somebody who leads the team — an outstanding researcher. Thus, the relationship system of the universities and the research institutions should be assessed on the basis of the place where the team leader's job is. If he works at the research institution, the educators participating in the work should be assigned to the project carried out in the research institution. If he works at the university, the staff members of the research institution should be assigned to the project carried out in the university. It is evident that there will be fewer of the latter than of the former since presently there are relatively few professors who established a scientific school and who perform major research work in addition to the teaching duties in cooperation with the staff and perhaps others. We wish that there would be more university departments where a scientific school develops around a good professor. This would give true meaning of the university research work and would create optimum combination of educational and research work.

4. In giving an answer, I would start by saying that we should give more recognition, mainly moral recognition, to scientific work which yields major results. I stress this in part because today we seem to emphasize material recognition at the expense of moral recognition. Moral recognition, in my opinion, is at least as attractive as material recognition. The various methods of moral recognition are likely to contribute to increased democratization of scientific life. Relatively simple steps may be useful, for example

- Citing the authors and the team members in the final reports;
- Widespread dissemination of the project reports if they have been approved by the appopriate organs, assistance to publication;
- Recognition of the merits of the project in scientific qualifications (even in cases where the candidate was a team member, not working on his own);
- Extending an invitation, whenever feasible, to the meetings of those organs where the research report is evaluated (scientific societies, industrial associations, political bodies, or branch organizations).

If we make increased use of the methods of moral recognition, we already contribute to the increased democratization of scientific life since we may expect a much greater uproar if recognition is given to a non-deserved work than in the case of a material recognition. Taking this fact into consideration, we may try and involve the scientific public already as we decide about granting the various kinds of moral recognition. In the case of a cash bonus and also in the case of other manifestations of material recognition the possibilities of democratic procedure are much fewer than in the case of the various manifestations of moral recognition (wide consultation, professional debate). For example, if the moral recognition involves publication of the material, those opposing the recognition have a better opportunity to express their views than in the case where somebody receives a bonus for work well performed.

"The Thematic Scope of Our Long-Range Scientific Plan is Still Too Broad" [opinion of Gyorgy Vajda, academician, director of the Research Institute of the Electric Power Industry]

1. One of the greatest stumbling blocks of our science supervision is that it uses the same yardstick for approaching research which serves the economy as research which serves the social superstructure. Yet, these two area activities feature quite different goals and terms of reference, and I believe that the appropriate needs should be formulated differently.

I have deliberately not mentioned science disciplines since a typical feature of our era is that many natural sciences (such as physics, chemistry, and biology) are involved in the solution of problems of our economy, while we would need to include quite practical trades in the study of matters related to the superstructure. It would be useful to implement this approach in our science-planning practice also; we do not implement it systematically in the present structure of the OTTKT.

Among the research activities forming part of the superstructure I would include those researches where the goal is to acquire new knowledge, to explore new laws, and to some extent to acquire knowledge from abroad to upgrade the domestic level. This is the area where the traditional practice of scientific work, which has evolved over centuries, may be continued, where the free choice of themes can be provided, where the success is manifested by the number of publications and their international recognition, and where the personal interests and ambitions of the researchers play an important role. In this sphere I believe that we should not set up unduly detailed research plans; there, the task of science supervision should be merely the distribution of the financial resources and cadre sizes. It seems likely that we could perform the thematic planning best through appropriate scientific teams, designating the preferred trends and tasks, as well as by proper scientific evaluation of the results.

Insofar as studies serving the economic base are concerned, we should realize that a practically new scientific industry has developed on a worldwide scale. In this area the acquisition of new knowledge and the exploration of new laws is not the ultimate goal; the ultimate goal is to realize new products, new production methods, and new methods of organization. The success of this activity is the time, intellectual effort, and financial effort expended, and the extent to which the relationship between research and application is established. For this reason, we should find more effective methods for research planning in these areas. It is not right to use the conventional procedures for research involving the superstructure. For example, free theme choice would lead to a fragmentation of the efforts. If we were to measure success on the basis of the number of publications and dissertations, we would deflect the scientists from realization and goal-oriented approach. The OTTKT was a major step forward in this direction; however, it was not a large enough step to ensure that our activity serves fully the major specific needs of our industry and agriculture. The scope of our long-range research plan is still too broad; almost everything could be fitted into it (since it was prepared so that each and every institution is pleased), and the goals are not tied to specific production goals. This means that economic and science policies are not yet

assigned properly to a full entity. It is here that I feel that out most important task is to outline those production tasks which are to be served by the research activity. This research activity would represent the economic base.

2. In studies serving the superstructure, the selection is more or less determined by the distribution of the intellectual and financial resources. I would also include in this category those activities which are aimed at maintaining our industrial and agricultural level, and the acquisition of knowledge from abroad to ensure that we have a proper professional and technological background. In studies serving the economic base, I believe that the selection should not be accomplished with the aid of organizational measures. Rather it should be accomplished with the aid of task-oriented approach and the concentration of the financial resources to the major production goals. This does not mean at all that we endeavor to dull the activities or that we desire the withering of those institutions which do not serve directly the production sphere. In my own field, for example, we work successfully and intensively with mathematicians, physicists, chemists, biologists, meteorologists, economists, and many other scientists in a variety of natural and social sciences — working in a variety of institutions including some academic research institutions — toward the solution of energy-related problems.

3. The conditions of the universities are primarily such that they are suitable for carrying out research serving the superstructure. In these areas it may make sense to grant some sort of monopoly to the universities, and we should give serious thought to the question whether many of the research institutions with specifically such a profile would not operate more efficiently if they would be integrated organizationally into the university system. University education would also benefit from the participation of the most outstanding scientists. At the same time, most of the industrial and agricultural tasks require a concentrated intellectual and material expenditure, which would be difficult to provide in the universities. The critical mass required for successful work could be provided primarily in highest-level institutions. Of course, this does not exclude the possibility of including the intellectual base of the universities in the solution of specific problems. If we manage to line up the research plans toward the goals of our economic policy, we could obtain tight schedules which force the most intensive utilization of all intellectual capability available, including that found in university departments.

4. I must admit honestly that I hesitate to touch upon this question, which is fermenting since several decades, because the conditions have actually deteriorated in recent times. Specialization of the sciences resulted in the fact that there are increasingly fewer people with competence in a specialized field, so that the conditions of concrete professional debates are increasingly difficult to provide. The situation is made additionally complicated by the fact that the institutes must see to it that "each shot they fire reaches the bull's eye" since it is on this basis that they are evaluated: the existence of an institution may depend on the result of the evaluation. This is not conducive to the debating spirit. Practice is the best yardstick for the success of research aimed to serve production. We want to know the extent to which the implementation of the results helped production. The critical attitude might be best developed on this basis. The academy could do much toward this goal. It should forget about prestige considerations and present an example of truly professional debates to the scientific public.

"The Best Investment Is the Selection of Truly Talented Young People" [opinion of Janos Zambo, academician, professor at the University of the Heavy Industry]

As I see it, research and development has three sectors: the exploration of new scientific knowledge, the intellectual preparation of modern production, and effective cooperation with the production process. In my opinion a major criterion of successfulness is that intellectual and financial resources should be committed only to themes which serve one of the three sectors in the proper ratio.

A true scientific breakthrough is rare everywhere, and so it is in Hungary. This is in spite of the fact that the number of publications and dissertations is high. It seems that both tend to be self-serving. A true debating spirit is not in our makeup. In our small country there is not much personal acquaintanceship, although in some places we see examples of true cooperation and mutual dependence. We can afford the luxury of having scientific researchers and university educators. Only large countries can afford this luxury, although it is true everywhere that the greatest scientists are not necessarily the best educators — and, vice versa, the best educators are not necessarily the most outstanding scientists.

Concentration does not come easily in the realization of the featured tasks as we perform the intellectual preparation of modern production methods. It seems that there is no way to put a stop to the dispersion of the forces.

The tasks are still outlined in a too generalized manner; we tend to see themes in a subject area which do not serve the overall goal or serve it only slightly. We still tend to measure our work in terms of quantity rather than in terms of quality. This is why we write so much and prepare so many self-serving dissertations. No wonder that many of the papers and dissertations are destined to be collectors of much dust in a short time. What is the sense of a conference, attended by many people and costing a great deal of money, if a few months later the participants forget about it entirely? What is the usefulness of "material" gathering dust in a drawer?

Cooperation with production is by no means complete yet, and where it is, its main feature is slow speed. As if time, one of the most important factors, would be unimportant entirely.

In my opinion, one of the most important tasks is to reduce the intellectual and financial effort in a gradual manner in those areas which — through no fault of their own — fail to serve any of the three above-mentioned sectors. This is not an easy task to accomplish, and it needs just about the same time as it took for the wrong ratios to develop.

The researchers working in the first sector should be brought closer to the universities. This would not mean that the achievements would necessarily become more numerous, but it would increase the level of university education. This is important for the future.

The second sector needs most constructive and systematic changes; there, in my opinion, the planning institutions should effectively steer toward the production process. Being an engineer myself, I cannot hide my opinion, which may appear odd: In the development sphere I consider a young, talented engineer who sees the world after a few years' of industrial work and learns foreign languages more promising than an engineer who prepares a candidate dissertation enclosed by four walls. It is a proven fact: the best investment is the selection of really talented young people, giving them every opportunity to develop.

In the third sector, work should be performed only on specifically outlined tasks, wherever needed in industry and agriculture. Here, as well as in the second sector, we should increase the moral and material responsibility, and the material reward should be tied to the true economic achievements.

"The Higher Authorities Should Plan the OTTKT Themes More Carefully in the Future" [opinion of Istvan Soter, academician, director of the Institute of Literary Sciences of the MTA]

The Institute of Literary Sciences of the MTA held a department heads' meeting on 9 November 1977 to discuss the document entitled "Experiences and Current Tasks of the Implementation of the Science-Policy Guidelines of the MSZMP KB," which was published in No 9 of the 1977 volume of MAGUAR TUDOMANY. Responding to the request of the editorial board, I herewith present the major conclusions reached at this meeting. The views agree with my personal views and those of my colleagues.

The conference of the department heads found the text of the document precise, comprehensive, and instructive. According to the conference of the department heads, the document properly summarizes the lessons learned since the promulgation of the science-policy guidelines of the Central Committee, and it outlines principles which the Institute fully endorses and will fully implement in its activities.

Already during the preparation of the present medium-range plans the Institure stressed the need for intensive development, which it regards as a most important science-policy guideline. In this connection, the Institute will seek, as it already does, means of cooperation with the associated sciences. The conference firmly resolved to promote interdisciplinary cooperation, specifically toward the trends of the international development of the literary sciences. It is cognizant of the fact that literary sciences have never isolated themselves but monitored the other sciences and implemented their applicable accomplishments.

The conference agreed with the statement of the document about the OTTKT themes. Indeed, long-range interdisciplinary planning must be the true base of research. This is why the higher authorities should plan the OTTKT themes more carefully in the future. It is inadvisable to structure interdisciplinary plans meant for 15 years every 4-5 years, especially not if this involves changes in the base institution and major changes in the original goals. To become the bases of research, the OTTKT themes must be firm and progress dynamically on the basis of a fully thought-out approach. Only then will it become possible to rely on them and follow them.

The Institute presently participates in OTTKT programs. But the conference found it desirable to recommend the formulation and implementation of the "main national trend" as soon as possible. This would permit the Institute

to find its way toward cooperating with the major and individualized tasks of literary sciences, and work in cooperation with the sister institutions and sister disciplines so as to do justice to the principle of interdisciplinary development, which is a correct principle. Until this main trend is formulated, the Institute cannot fully implement this principle, as outlined in the document.

The Institute regards it desirable to establish an information system in the field of social sciences. The establishment of constantly updated social science bibliographies should be considered by the appropriate experts. The situation in this respect deteriorates rathes than improves. Information lags behind the rapid advancement of the sciences. The libraries are inadequate in relevant bibliographic respects. The situation must be changed. Agreeing with the theses outlined in the document, the Institute stresses the need for making science administration and organization more flexible and simpler. A condition of intensive scientific work is logical and simple administration; this does not exist to the desirable degree at the academy. It would be desirable to make the general academic procedures (such as those concerning planning and reporting) more tailor-made for social sciences in general and human sciences in particular.

The conference stressed the importance of the modernization of the TMB [Committee of Scientific Qualification] system.

"Development Should have a Proper Base in Production..." [opinion of Karoly Szendy, academician, chief expert at Power Plant and Electric Distribution System Designing Enterprise]

Industrial and agricultural production became more modern in our socialist system; the economic health improved; and public education became broader-based. I desire to comment on the above-cited document, specifically insofar as it concerns the goals which are aimed at ensuring our further progress. These remarks pertain to project-type research and development work associated with industrial and agricultural production.

According to Paragraph 2 of Section II.4.c. of the document, a financing system for the project is needed only if the goals can be unambiguously formulated and monitored. For this reason, more attention must be given to the proper grouping of the properly selected tasks, and the establishment of the proper decision points with respect to personal, material (equipment and instrument), and cost factors. The decision points should designate the goal and the time. Attention must also be given to the production background (such as manufacturing technology) and marketing in conjunction with research and development.

Among the target-oriented vertical projects, some model tasks should be designated. They should be of the kind not solved by others on our behalf yet would meet our needs in the light of the domestic conditions. Such items may be found in the energetic central research target program, now under development.

Within the organizational forms of research/development and production, but also within other organizational forms, the establishment of good personal relationships is one of the most important features. Paragraph 3 of Section I.3. of the document refers to this too. In my environment I have always tried to implement good human relations. This relationship must encompass the entire verticality, meaning the range between production and research. I deliberately placed production ahead since production plays a decisive role in project research. This would eliminate the anomaly where a new method is developed only to find that there are obstacles in the way of its production implementation. We must stress the importance of being well informed, beyond the boundaries of the subject matter. It is my belief that one may very well advance the implementation of the proper methods through his good personal relationships without being fully familiar with the details of the manufacturing technology. The researcher-developer may assist in technological problems too and may modify parts of his own concept if it is desirable to do so.

Section I.5.b. of the document points out that the presently employed method of financing and economic management does not provide adequate incentive for the featured themes. Indeed, in order to have development at all, the proper ratios must be found in the highest-level research institutions and universities. Actually it is in the best interests of the scientists in both types of institution to ensure that their creative work is appreciated not only within a narrow circle but also on the international level. I believe that the moral incentives are very important in addition to the material incentives in the case of properly chosen individuals.

It may pay to study the question how to ensure the long-range development of the national economy and by what measures. It must be realized that the realization deadlines of the research results may sometimes change significantly. Although long-range realizability increases the risk and decreases the efficiency, we still may have to take these risks and accept the efficiency decrease in some justified instances that exist in view of our domestic situation.

On the basis of the foregoing we find that the present incentive system affects the day-to-day affairs directly, but does not take the more distant future into consideration. MTA and OMFB initiative would be desirable here.

A condition of the success of target-oriented research is that the research and development has a proper production base. It is generally difficult to ensure the cooperation among decentralized enterprises from the research-development angle.Similar problems develop if there are only generally outlined industry-development ideas. Contradictory situations develop if the development concept of the production sector is not completed on time for one reason or another.

In accordance with Section II.5.a. of the document, we must endeavor to ensure that in the future (from 1980 onward) the acaedmic institutional research plans contain a few forward-pointing and novel themes, which permit us to come to the forefront. Such international accaim may effectively advance the high-level international cooperation work of the academy. This is a development judged desirable by Section I.4. of the document also.

Section II.8. of the document points out the important factor that the changeover of science into a direct production force extends the increase in the general and specialized educational level to wider regions of society. The scientific societies and associations have an important role to play in this connection. It is highly desirable that the scientific experts take increasingly part in this public-service activity. A less formalized interchange of scientific knowledge and operating experience may be promoted thereby. These personal relationships enable us to prevent an undesirable bias which may otherwise result because of social and economic development.

2542
CSO: 2502

LARGER FISH PRODUCED THROUGH GYNOGENESIS

Budapest HAZAI TUDOSITASOK in Hungarian No 10, 15 May 78 p 6

[Excerpts] It is well-known that in the case of many fish the female is larger than the male. Theoretically, a fishpond contains only females would yield 30 percent more fish from the same amount of fish feed as one containing a mix of the sexes. Attempts to achieve this desirable result are now being made at the Temperature-Controlled Water Fish Breeding Farm (THEHAG) in Szazhalombatta through the efforts of the farm's researchers working with those of the Department of Behavorial Genetics of the Lorand Otvos University of Sciences.

Initially, the sperm of a normal male carp is irradicated with gamma or X-rays, using a dosage which destroys DNA but leaves the protein intact. Thus neither male nor female chromasomes can enter the roe. However, since the protein remains unchanged, it can still fertilize. However, the progency can be only female.

The experiments have been underway since 1974. At present, the third generation of carp is involved. The goal is to completely inbred lines and a stocks of hybrids. The fishpond of the Dozsa agricultural producer cooperative already has a population of 300,000 carp of a single sex.

The further breeding of this monosexual population has been solved by turning a young female fish into a male by hormone treatments. However, this male has only female XX chromasomes. When this fish is mated with a regular female, only females are born again. This sex change was performed for the first time anywhere with carp at Szazhalombatta at a farm established with the cooperation of FAO.

CSO: 2502

NEW TECHNOLOGY FOR COKE MANUFACTURE EXAMINED

Bucharest METALURGIA in Romanian No 1, Jan 78 pp 5-11

[Article by Dr E. Falk, of the Bucharest Institute for Metallurgical Research, Eng G. Dinescu and Eng Ana Partenie, of IPROMET-Bucharest: "Considerations on the Stage Reached by the Use of Various Technologies in Coke Manufacture, Aimed at Expanding the Raw Materials Resources for Coking"]

[Text] Romania's steel industry and coke production have developed as shown in table 1, and are expected to continue this sustained growth in the future.

Table 1. Development of Romania's steel industry (percent).

	1970	1975	1980
Steel	100	146	260
Cast iron	100	155	282
Coke	100	213	514

This rapid growth in coking capabilities raises many problems, to which our specialists will have to find technical solutions that can be used in the plants which remain to be built during the next five-year plan.

The present paper summarizes and compares the information published in the literature on modern coking technology, seeking to indicate the optimum conditions for steel manufacturing.

Criteria for Selecting Coke Production Techniques

In general, the cost of raw materials represents 80-90 percent of the cost of metallurgical coke. As a result, priority will have to be assigned to those techniques that allow the processing of the largest possible amounts of non-coking cheap coal, whose cost is currently 0.7 of the cost of good coking bituminous coal. In the future, coke production will have to be achieved with lower energy consumption. Coking consumes about 550 kcal/kg of charge, of which about 200 kcal can be recovered by dry quenching of the coke.

Manpower shortages are increasingly being felt in the coke chemistry industry. The heavy labor performed under arduous conditions around coking batteries leads to large personnel fluctuations at all coking plants throughout the world. These can be avoided by increasing the labor productivity of coking batteries - the most difficult sector in coke plants, and by eliminating or reducing the noxious gases released particularly during the loading and unloading of coking ovens.

The techniques selected for use under industrial conditions must be free of risks to planned technico-economic indicators.

Techniques for Coke Manufacture

The technical processes involved in coke manufacture can be grouped according to the diagram shown in figure 1.

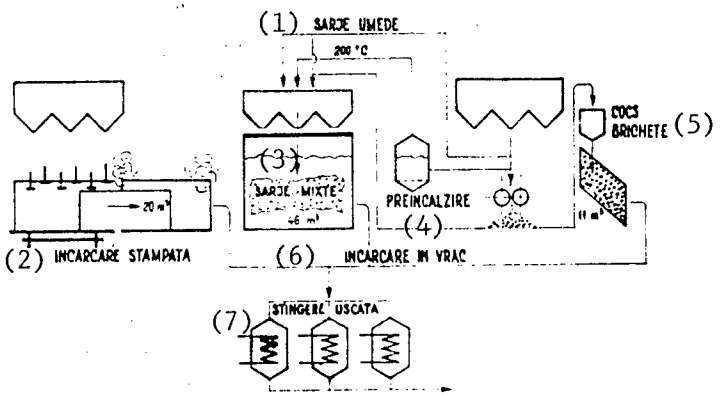

Figure 1. Technical processes involved in coke manufacture.

Key: (1) Wet charges
(2) Tamped loading
(3) Mixed charges
(4) Preheating
(5) Coke briquettes
(6) Bulk loading
(7) Dry quenching

Many papers have been written about the various alternatives for optimum blending of coals (recipes), optimum preparation of charges (grinding), and formulating degreasing additives (fine coke) or improvers (petroleum residues).

The effect of steps taken for the optimum preparation of charges is shown by the indicators obtained by Japanese specialists (table 2).

Table 2. Influence of charge preparation on coke strength and battery productivity (metallurgical coke) (1, 5).

(A) Măsura în pregătire	(B) Creşterea rezistenţei cocsului*		(C) Creşterea productivităţii	(D) Observaţii
	$+M_{40}$	$-M_{10}$		
(E) Uleierea şarjelor (vrac)	0,2—0,4	0,05—0,1 (F)	5% (prin creşterea greutăţii volumice a şarjei)	3% adaos (G)
(H) Măcinare diferenţiată (vrac)	0,6—1	0,1—0,2	—	—
(I) Uscarea şarjei (vrac)	1—2,0	0,2—0,5	10—15%	—
(J) Preîncălzirea şarjei (vrac)	2—4,0	0,5—1,0	40%	preîncălzit la 250°C (K)
(L) Degresare cu cocs mărunt fin măcinat (ştampare, vrac)	2—6,0	+0,5	5—7	prin reducerea fisurării (M) şi a măruntului
(N) Adaos de ameliorant petrolieri (smoală tare, ştampare, vrac)	2—3,0	0,5—0,7	—	2—3% adaos (O)
(P) Brichetarea parţială a şarjei cu liant	2—3	0,5—7	5%	30—40% brichete din şarjă (Q)

(R) * Recalculat de autori după valori D_{15}^{30}

Key: (A) Preparation step
(B) Increase in coke strength*
(C) Productivity increase
(D) Comments
(E) Charge oiling (bulk)
(F) As a result of higher charge volumetric weight
(G) 3% addition
(H) Differential grinding (bulk)
(I) Charge drying (bulk)
(J) Charge preheating (bulk)
(K) Preheated to 250 °C
(L) Degreasing with small grained coke fines (tamping, bulk)
(M) By reducing fissuring and fines
(N) Addition of petroleum improvers (hard pitch, tamping, bulk)
(O) 2-3% addition
(P) Partial charge briquetting with binder
(Q) 30-40% briquettes in charge
(R) *Recalculated by the authors from the values of D_{15}^{30}

The effect of any given step that can be taken to prepare the charges is of course not always the same, and depends on the specific nature of the raw material. The work done at ICEM (Institute for Metallurgical Research) shows that the influence of the technical steps taken in coal preparation and processing falls in the order given in table 2.

Table 3. Recipe limits as a function of technical conditions.

	Poorly coking coal		Imported coal	
	Group 623	Group 700-711	Improver	Degreaser
Tamping	0-50	50-0	30-50	0-10
Wet bulk loading	0-50	35-0	40-50	0-10
Preheated bulk load	0-60	45-0	40	0-15
Mixed bulk loading	15-45	25-0	40-50	0-10
ICEM* coke briquettes	--	87	13 pitch	--

* 30% imported or petroleum coke has to be added in order to improve the chemical composition of the coke (Romanian coals contain large amounts of sulfur)

The improved coke strength observed for the various techniques can be obtained through better utilization of ovens, or through the use of poorly coking but cheaper coal. The most interesting alternative is obviously the one that will produce coke of a quality determined by the ovens, from charges that include the largest amount of cheap coal available locally.

Inclusion of Romanian Coal in Charges Coked With Various Techniques

The experiments conducted by ICEM and verified in industry with the collaboration of coking collectives and oven operators, have yielded recipe limits presented in table 3. They show that the future development of coke production will have to take into consideration the technical alternatives which enable the charging of at least 45 percent coal rated by the ISO as groups 623 and 700-711; under current definitions, these groups are considered as non-coking coals. This condition can be met by any of the alternatives shown in table 3, with the exception of bulk loading of wet charges.

Compared with the other alternatives, the manufacture of coke briquettes has the advantage of replacing imported improved coals with imported energy producing coals that contain low amounts of sulfur and ash.

Specific Energy Consumption for Various Coking Alternatives

Given that the energy consumption for coal grinding is the same in all cases, the following differences arise in comparison with bulk loading of wet charges:

1. Tamped coking requires an additional energy consumption for degreasing, grinding of the degreaser, and tamping.

2. Bulk coking of preheated charges requires energy for preheating, but this energy is recovered by the shorter duration of coking.

3. Bulk coking of mixed charges increases the energy consumption because 30 percent of the load is formed into briquettes.

4. The manufacture of coke briquettes increases the energy consumption because the entire load has to be formed into briquettes, and because the thermal efficiency of the smaller and less advanced coking ovens is lower than that of the high productivity ovens used for bulk coking.

Since the energy consumptions are usually measured per ton of metallurgical coke, these consumptions are increased by the values of metallurgical coke yields specific to each technique.

Using the data available in the specialized literature, the following energy consumptions have been calculated per ton of produced metallurgical coke (table 4).

Table 4. Consumption of specific energy consumptions for various coke manufacture techniques (percent).

Tamped coking, degreased charges	100
Bulk coking, non-degreased wet charges	90
Bulk coking, preheated charges	79
Bulk coking, mixed charges	94
Coke briquettes	153 (part of which is the result of semi-coking of some of the charge)

The figures of table 4 indicate that the development of coke production will have to consider the following alternatives for reducing energy consumption:

Bulk coking of preheated charges;
Bulk coking of mixed charges;
Coking of tamped charges.

The bulk loading of wet charges cannot be considered because it involves a minimal use of poorly coking coals.

Labor Productivity and Environmental Pollution

According the specialized literature, the production of metallurgical coke per battery worker varies as shown in table 5.

Table 5. Labor productivity (tons of coke/worker/year).

	Labor productivity (%)
Tamped coking	100
Bulk coking, wet charges	133
Bulk coking, preheated charges	183
Bulk coking, mixed charges	123
Coke briquettes	42

The environmental pollution caused by the various alternatives falls in the following order, from maximum to minimum: tamped coking, bulk coking of wet and mixed charges, coke briquettes, and bulk loading of preheated charges.

The labor productivity at bulk loading batteries is higher than at tamped loading batteries because the volume of the coking ovens is nearly twice that of the latter. For instance, in 1976 the capitalist countries had 56 batteries with a larger chamber volume of 30 cubic meters and a distribution as shown in table 6; at the same time, the volume of coking chambers for for tamped loading batteries did not exceed 22 cubic meters.

Table 6. Worldwide distribution of high capacity batteries.

Chamber volume, m^3	Number of batteries	Countries
30-33	8	Canada, Australia, England
37-40	24	Japan, England, Italy, Holland
41-46	8	Japan, USA
over 46	16	Japan, West Germany

The productivity of coke briquette batteries is reduced by the volume of the coking chambers which can be unloaded vertically, and which are smaller than the chambers of bulk loaded batteries. The literature also mentions that Japan has conducted successful experiments with slanted ovens for coke briquettes, whose chamber volume is 20 cubic meters (7). Because in the 1-2 years of their operation no estimates could be made of the duration between capital repairs, and so on, the development of this technique is at a disadvantage. The productivity of preheated charge coking is improved by the fact that the preheating units can be operated by 1-2 workers per shift, and that the loading of batteries is automated.

The order of priority established in the preceding paragraph is maintained from this standpoint as well.

Achievement of Technico-Economic Indicators With the Various Alternatives

Tamped coking has been used for about 100 years in 6 percent of the installations that currently produced metallurgical coke. Its use does not imply any technical risk.

The technique of bulk coking has also been used for more than 100 years. The only caution in connection with its use is to select a coking chamber volume that has been sufficiently well proven in operation. The technique of bulk loading offers the advantage of being adaptable to the loading of briquettes in mixed charges, and to the loading of preheated charges; both alternatives considerably increase the raw material base for coking, while providing large coking chambers.

Three processes for bulk loading of preheated charges are used throughout the world; until now, these have been described in a few lines in our specialized literature, and they are: the Coaltek process (USA and France), the Simcar process (England), and the Precarbon process (West Germany).

So far, installations have been built to preheat about 14 million tons of charge per year, and these are located primarily in USA, England, and Japan (table 7).

Table 7. Worldwide installations for charge preheating (1977) (7, 10, 12, 15, 16, 17).

Process	Company, coking plant	Preheating capacity
Coaltek (USA and France)	Allied Chemical, USA, Ironton	1 x 40 t/h (pilot)
	Detroit	2 x 72 t/h
	Inland Steel, USA, East Chicago	2 x 90 t/h
	Alabama Byproducts, USA, Tarrant	2 x 72 t/h
	British Steel Corp., England,	
	Red Cap	3 x 80 t/h
	Scunthorpe	2 x 80 t/h
	Carling, France	1 x 36 t/h (pilot)
	James Laughlin, USA, Aliquippa	2 x 90 t/h
	Norbottens Jarnwerk, Sweden, Lulea	3 x 80 t/h
Simcar (England)	British Steel Corp., England	
	Brookhouse	1 x 30 t/h (pilot)
	Orgreaue	1 x 55 t/h
	Iscor, South Africa, Pretoria	3 x 100 t/h
	Rhodesian Steel Ind., Rhodesia,	
	Wankie	1 x 55 t/h
Precarbon (West Germany)	Ruhr Kohle, Emil	10 t/h (pilot)
	Prosper	10 t/h (pilot)
	U.S. Steel Corp., USA, Gary	3 x 100 t/h
Japan	Nippon Steel, Oita	3 x 100 t/h
	Muroran	3 x 100 t/h
	Total charge preheated per year	14,000,000 tons

Based on the specialized literature data, one can consider that preheating with pneumatic transportation, adopted for all three techniques, implies no risk whatsoever.

The preheated charges are loaded through conduits in the Coaltek systems, with a loading car in the Simcar system, and with a Redler chain belt in the Precarbon system.

The optimum alternative will have to be selected according to criteria that take into consideration reliability, strains on the battery construction, influence on subproduct quality, battery loading automation, and so on.

The application of preheating (an additional and costly operation) must be economically justified through the use of charges that contain cheaper coals than those used in the bulk coking of wet charges. This requires a study that can be conducted only by means of industrial tests which will establish limiting recipes with maximum contents of poorly coking coals, as well as the production increase allowed by the coke quality obtained in high capacity ovens; the latter because the large amount of published data provides only few indications about tests conducted with coals similar to our non-coking coals (high content of volatile matter, poor cohesion and coking properties) (8, 9, 10, 15, 16, 17). The only indication of experiments conducted with coals that have an expansion factor of -21 and -35 percent has been published by Dr Rhode (15). The test has produced coke with wharf (unstabilized) characteristics of: M_{40} = 64.0 %, M_{10} = 10.8 %, and average diameter = 68.2 %; these are somewhat similar to the characteristics found at quenching wharfs for cokes produced in tamped loaded batteries. The production was 60 percent higher than that of bulk coking of wet charges.

The bulk coking of mixed charges of briquettes and coal has also been described on several occasions. Within six years, this technique was developed in Japan as shown in table 8.

Table 8. Briquette production for coking in mixed charges (January 1977) (1-7, 11-14).

Company	Installation	Production, t/day
Nippon Steel	Yawata	2,400
	Kimitsu	2,900
	Tobata	2,300
	Ohita	2,400
Nippon Kokan	Keihin	800
	Fukuyama	3,000
Sumimoto Metal	Wakayama	1,700
	Kashima	4,700
Kobe Steel	Kakogawa	3,000
Total, t/day		23,200
t/year		8,000,000
Total mixed charge (30% briquettes)		27,000,000 tons

In general, only part of the charge consists of briquettes, with the poorly coking coal being added both as briquettes and in the remainder of the charge. In this case, the literature mentions contents of 20 percent non-coking coal (V^a = 11-39 %, U.L. = 0), these charges producing coke whose characteristics at the furnace skip loaders are: M_{40} = 79.4 %, M_{10} = 9.2 %, and average diameter = 50-70 mm.

The industry has recently begun to use mixed charges composed of 30-40 percent briquettes, themselves containing 70 percent power producing coal and several percent petroleum pitch with a high softening point (11, 12). In this way the content of non-coking coals in the charge can be increased to 28-30 percent.

The briquette manufacturing technique is known, and its use implies no risk. A briquette fabrication installation in Japan, with a production of one million tons of briquettes per year, is operated by 30 workers. In Japan, this operation uses presses of 40 t/hr and consumes 12 kWh, 80 kg of steam, 20 kg of water, and 0.2 cubic meters of compressed air per ton of briquettes.

The installation covers an area of about 7200 square meters. The mixing of briquettes in the charge remains a problem. In Japan, this is done by measuring briquettes and charges into the loading car, from separate compartments of the tower. The loading system does not require extensive modifications.

The use of mixed charges does not significantly change the yield of subproducts. The amount of insoluble fractions in the tar is not changed.

The adaptation of this technique is considered to imply minimum risk because by using the recipe, experience, and patents of ICEM for coke briquette fabrication, the charge can contain 26-35 percent non-coking coal, and because if the first approach does not produce industrial results, the same installation could use the Japanese technique with 20 percent non-coking coal in the charge.

A comparison of preheating and mixed charge costs at ICEM is shown in table 9, which indicates that the production costs of mixed charges and preheated charges are practically identical.

Table 9. Comparison of technico-economic indicators estimated for mixed and preheated charges (percent).

Indicators	Traditional bulk	Mixed charges	Preheating
Production costs	100	104.3	102
Currency for raw material imports	100	71.4	82.0
Specific investment	100	103.3	83.6

The specific investment for the preheating case is lower.

These figures are of course presented solely as guidelines and would have to be verified in a feasibility study.

In 1977, coke briquettes were manufactured throughout the world as shown in table 10.

Table 10. Coke briquette manufacturing (7) (exclusive of the thermally oxidized coke produced in Poland).

Company	Time since installation	Capacity t/day	Capacity t/year
ICEM (Romania)	15 years	140	50,000
Food Machinery Corp. (USA)	8 years	270	100,000
H. BNPC (France)	3 years	150	60,000
BFL (West Germany)	2 years	300	100,000
(England)	1 year	300	100,000
ANCIT (West Germany)	3 years	250	90,000
DKS (Japan)	2 years	150	60,000
Total		1,560	560,000 (about 1,000,000 tons of charge)

The operating installations are in USA, Romania, ANCIT in West Germany, and DKS in Japan. It is obvious that Romania has acquired exceptional experience through the Calan installation that was opened in 1962.

The coke briquette manufacturing technology has the following general difficulties (2, 3, 4, 7):

It is difficult to develop industrial equipment of high productivity and durability;

The techniques are complicated, and the cost of installations is therefore higher than that of traditional coking plants;

The operating lifetime of equipment is shorter than that of traditional coking plants (briquette presses, ovens);

The coke has a high strength but is also heavy and wears rapidly. These problems are specific to coke briquettes, and together with the fact that the carboxyreactivity of the binder (which encloses the coal) is different from that of the coke, lead to problems when the coke is used in furnaces;

The yield of subproducts is poorer (quantitatively and qualitatively) than that of traditional coking plants;

Maintenance expenses are relatively high.

Based on the above, some Japanese specialists (4) estimate that the price of coke briquettes will be higher than that of traditional coke, while the process savings are derived primarily from the lower cost of raw materials as compared to the cost of the materials used in conventional coking. That is why the manufacturing processes for coke briquettes are considered to complete the choice of non-coking coal used in coke manufacturing. These negative comments about coke briquette manufacturing can of course be balanced with a large number of optimistic opinions. Nevertheless, judging by the existing capabilities (1 million tons of charge per year as compared to 24 million tons of mixed charge, and 14 million tons of preheated charge), and by the rate of expansion of these installations, the development of the coke briquette technique is considered to depend on the construction and timely check of industrial coking installations, and on the performance of long range tests at the ovens.

As a result of the above, the technical solutions can be classified in increasing order of risk as follows: coking of charges by tamped loading, coking of charges bulk loaded into high capacity ovens, bulk coking of mixed or preheated charges in high capacity ovens, and coke briquette manufacture.

Final Considerations

Summarizing all the criteria for the solutions to be considered in the development of the coke production, it appears that the bulk loading of preheated charges represents the optimum alternative from the standpoints of labor productivity, energy consumption, investments, and pollution.

The coking of mixed charges could be adapted to existing bulk coking plants in order to increase the use of non-coking coal in coke production.

The fabrication of coke briquettes can be considered for small and medium-sized production facilities. The optimum capacity for coke briquette production will be determined only after an examination of all the problems that have not yet been solved in an installation whose capacity is for the time being determined by the needs of researchers.

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